Claims

1. A method of coating the internal surface of a device with a polymer, the process comprising the steps of:

(i) introducing into the device a solution of one or more monomers in a suitable solvent;

(ii) introducing a flow of an inert gas through the device; and

(iii) initiating polymerisation of the monomer solution.

2. A method as claimed in claim 1 wherein the device is a microfabricated device or a reaction vessel with an internal diameter of less than about 2mm

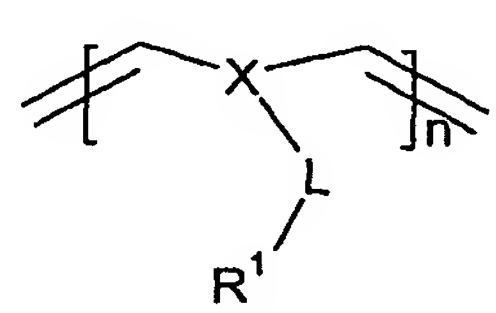
3. A method as claimed in claim 1 or claim 2, wherein the inert gas is nitrogen or argon.

4. A method as claimed in any one of claims 1 to 3, wherein the device is a microfabricated device or a loop from 1 to 100 cm in length.

5. A method as claimed in any one of claims 1 to 4, wherein the device is adapted to carry out a solid-phase radiochemical process.

6. A method as claimed in any one of claims 1 to 5, wherein the one or more monomers can be polymerised by ring opening metathesis polymerisation (ROMP) and the solution also includes a ruthenium carbene catalyst and a cross-linker.

7. A method as claimed in any one of claims 1 to 6, wherein polymerisation of the one or more monomers leads to a ROMP polymer of Formula (I):



(I)

wherein:

X is either a C_{4-6} cycloalkyl or C_{4-6} heterocyclyl moiety;

L is a C_1 to C_{20} linker group comprising one or more alkyl, alkenyl, alkynyl, C_{4-10} cycloalkyl, C_{4-10} heterocyclyl, C_{4-10} aryl, C_{4-10} heteroaryl, ether, PEG, sulphide, amide,sulphamide or a combination thereof; any of which may be substituted with one or more groups R^2

R^1 is hydrogen, C_{1-20} alkyl, C_{2-20} alkenyl, C_{2-20} alkynyl, C_{4-12} cycloalkyl, C_{4-12} heterocyclyl, aryl, heteroaryl, $C(O)R^3$, C_{1-20} alkyl-$C(O)R^3$, C_{2-20} alkenyl-$C(O)R^3$, C_{2-20} alkynyl-$C(O)R^3$, nitro, isocyanate, C_{1-10} alkyl-$C(O)$-$C(R^4)_2$-$C(O)$-C_{1-10} alkyl, aminooxy, nitrile, phosphorus chloride, succinimide, sulphonyl chloride, halogen, tosylate, mesylate, triflate, nonaflate, silane, OR^4, SR^4, $N(R^4)_2$, $N^+(R^4)_3$, quaternary phosphorous, C_{1-20} alkyl-R^5, C_{2-20} alkenyl-R^5 or C_{2-20} alkynyl-R^5 or a group comprising an enzyme or a catalyst.

R^2 is $C(O)R^3$, C_{1-20} alkyl-$C(O)R^3$, C_{2-20} alkenyl-$C(O)R^3$, C_{2-20} alkynyl-$C(O)R^3$, nitro, isocyanate, C_{1-10} alkyl-$C(O)$-$C(R^4)_2$-$C(O)$-C_{1-10} alkyl, aminooxy, nitrile, phosphorus chloride, succinimide, sulphonyl chloride, halogen, tosylate, mesylate, triflate, nonaflate, silane, OR^4, SR^4, $N(R^4)_2$, $N^+(R^4)_3$, quaternary phosphorous, C_{1-20} alkyl-R^5, C_{2-20} alkenyl-R^5 or C_{2-20} alkynyl-R^5.

R^3 is H, OH, C_{1-20} alkyl, OC_{1-20} alkyl, $N(R^4)_2$, $N^+(R^4)_3$;

each R^4 is independently H or C_{1-10} alkyl;

R^5 is OR^4, SR^4, $N(R^4)_2$, $N^+(R^4)_3$, C_{4-10} cycloalkyl, C_{4-10} heterocyclyl, aryl or heteroaryl.

8. A process as claimed in claim 7, wherein, in the ROMP polymer of Formula (I):
R^1 is halogen, OH, SH, C_{1-20} alkyl, C_{4-12} aryl, C_{1-20} alkyl-R^5, C_{1-20} alkyl-$C(O)R^3$, $N(R^4)_2$, $N^+(R^4)_3$ or a group comprising an enzyme or a catalyst.

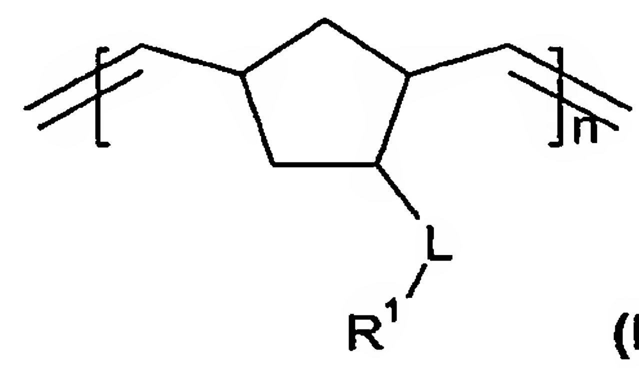
where R^3 is OH, R^4 is as defined for general formula (I) and R^5 is $N(R^4)_2$, $N^+(R^4)_3$, aryl or heteroaryl;

9. A process as claimed in claim 8, wherein, in the ROMP polymer of Formula (I) wherein R^1 is C_{1-20} alkyl; -N=C=O, -SH or $N^+(R^4)_3$, particularly with bound ^{18}F-fluoride ion

or comprises an enzyme or a catalyst; and R^4 is as defined in general formula (I).

10. A process as claimed in any one of claims 7 to 9, wherein the polymer of Formula (I) contains more than one R^1 group.

11. A process as claimed in any one of claims 1 to 10 wherein polymerisation of the one or more monomers leads to a ROMP polymer of Formula (II):

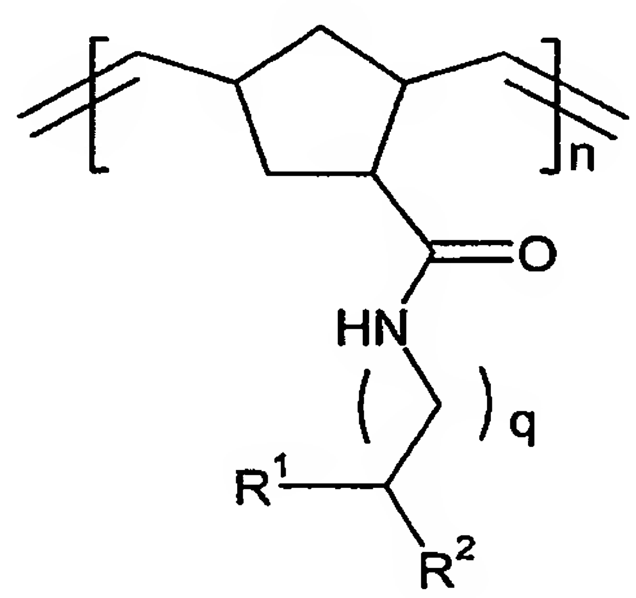


(II)

wherein:

-L -, R^1 and n are as defined above for Formula (I).

12. A process as claimed in any one of claims 1 to 11 wherein polymerisation of the one or more monomers leads to a ROMP polymer of Formula (III):



(III)

wherein:

R^1 and n are as defined above for Formula (I);

R^2 is an optional group as defined above for -L- of Formula (I); and,

q = 1-4.

13. A process as claimed in claim 12, wherein, in the ROMP polymer of Formula (III), R^1 is trialkylammonium, R^2 is absent, q = 3 and n = number of polymer units.

14. A process as claimed in any one of claims 1 to 13, wherein each monomer is

present in the starting solution in a concentration of from about 0.1 to 5M.

15. A process as claimed in any one of claims 1 to 14 wherein, in the monomer solution, the solvent is a polar aprotic solvent.

16. A process as claimed in any one of claims 1 to 15 wherein polymerisation is initiated by heating.

17. A process as claimed in any one of claims 1 to 15 wherein polymerisation occurs spontaneously.

18. A process as claimed in any one of claims 1 to 17, wherein the device is a microfabricated device and, the process of the invention comprises the initial step of creating a defined network of channels within the device.

19. A device comprising a microfabricated device or a reaction vessel with an internal diameter of less than about 2mm, wherein the internal surface is coated with a polymer substrate for a solid phase physical or chemical process.

20. A device as claimed in claim 19 adapted for carrying out a solid phase radiochemical process.

21. A device as claimed in claim 19 or claim 20, wherein the internal surface is coated with a ROMP polymer.

22. A device as claimed in any one of claims 19 to 21, wherein the internal surface is coated with a polymer as defined in any one of claims 7 to 13.

23. An automated synthesis system comprising two or more devices as claimed in any one of claims 19 to 22 which are fluidly interconnected

24. A method for recovering of ^{18}F-fluoride ion from ^{18}O-enriched water containing ^{18}F-fluoride ion, the process comprising passing the ^{18}O-enriched water containing ^{18}F-fluoride

ion through a device as claimed in any one of claims 19 to 22 or a system as defined in claim 23, in which the polymer coating comprises a ROMP polymer of general formula (III) in which R^1 is tri(C_{1-6} alkyl)ammonium, with a non-nucleophilic counter-ion, R^2 is absent and q is 3.

25. A method as claimed in claim 24 which is a step in the synthesis of an ^{18}F-labelled radiotracer.

26. A method for the synthesis of an ^{18}F-labelled radiotracer, the method comprising:

(i) recovering of ^{18}F-fluoride ion from ^{18}O-enriched water containing ^{18}F-fluoride ion passing the ^{18}O-enriched water containing ^{18}F-fluoride ion through a device as claimed in any one of claims 19 to 22 or a device as claimed in claim 23 in which the polymer coating comprises a ROMP polymer of general formula (III) in which R^1 is tri(C_{1-6} alkyl)ammonium, with a non-nucleophilic counter-ion, R^2 is absent and q is 3; and

(ii) introducing into the device an unlabelled precursor compound of the ^{18}F-labelled radiotracer such that ^{18}F becomes incorporated into the precursor compound *via* nucleophilic substitution to form the ^{18}F-labelled radiotracer.

27. A method as claimed in claim 26, wherein the ^{18}F-labelled radiotracer is:

2-[^{18}F]fluorodeoxyglucose (2-[^{18}F]-FDG);

L-6-[^{18}F]fluoro-DOPA;

3'-deoxy-3'-fluorothymidine (FLT);

2-(1,1-dicyanopropen-2-yl)-6-(2-[^{18}F]fluoroethyl)-methylamino)-naphthalene ([^{18}F]FDDNP);

5[^{18}F]fluorouracil; 5[^{18}F]fluorocytosine; or

[^{18}F]-1-amino-3-fluorocyclobutane-1-carboxylic acid ([^{18}F]-FACBC).